APPENDIX E – HERBICIDES

Table D-1. Herbicides Descriptions

Active Ingredient	Target Vegetation	General Effects to Vegetation
2, 4-D	Dyers woad, annual and perennial mustards, knapweeds, Russianthistle.	Controls most broadleaf weeds with little effect to most grasses. Group 4 MOA disrupts growth regulation in broadleaf plants resulting in uncontrolled growth and eventually death in susceptible plants.
Aminopyralid	Susceptible broadleaf weeds, including invasive and noxious weeds without injury to most grasses.	Both pre-and post-emergent effects on susceptible broadleaf plants. Group 4 MOA disrupts plant growth metabolic pathways, affecting the growth process of the plant including seed production and germination. Effects are greatest in the first year after application and are not significant by three years following application.
Chlorsulfuron	Dyers woad, thistles, annual and perennial mustards, Russian knapweed, whitetop.	Group 2, selective, systemic herbicide that inhibits the synthesis of branched chain amino acids, which stops cell growth.
Clopyralid	Knapweeds, thistles	Group 4, selective post-emergence herbicide used to control broadleaf weeds through plant growth regulation, altering metabolism and growth characteristics and often causing proliferation of abnormal growth. Can be especially harmful to legumes and asters but has little effect on grasses.
Dicamba	Dyers woad, knapweeds, thistles,whitetop, toadflax	Selective pre- and post-emergent, growth-regulating herbicide (Group 4) induces abnormal and uncontrolled growth, disrupting normal plant functions.
Diflufenzopyr	NA	Increases the phototoxicity of *dicamba* when used in formulation and is labeled as Distinct® and Overdrive®. Is not currently approved for use as a stand-alone active ingredient by the BLM.
Diflufenzopyr + Dicamba	Knapweeds, thistles, Russianthistle.	Selective post-emergent, Group 4 (*dicamba*) and Group 19 (*diflufenzopyr*) formulation which inhibits the transport of auxin in the plant resulting in an abnormal accumulation of auxin or auxin-like compounds in the growing points of susceptible plants and an

		imbalance in growth hormones in the plant.
Fluroxypyr	Broadleaf species suchas weedy (annual) kochia, mustards, and leafy spurge.	Selective post-emergent, Group 4 herbicide that causes uncontrolled growth in the targeted plant.
Glyphosate	Annual grasses, mustards	Non-selective systemic, broad-spectrum Group 9 herbicide that can damage or kill all groups of plants to varying degrees.
Imazapic	Annual invasive grasses and mustards	Selective, systemic, Group 2 herbicide that can be applied both pre- and post-emergence. Inhibits enzyme activity required for protein synthesis and cell growth.
Metsulfuron methyl	Thistles, annual and perennial broadleaf weeds.	Selective herbicide used pre- and post-emergence in the control of many annual and perennial weeds and woody plants.
Picloram	Certain annual and perennial broadleaf weeds, leafy spurge,rush skeletonweed, knapweeds, thistles.	Selective herbicide that is more toxic to broadleaf and woody plants than grains or grasses.
Rimsulfuron	Invasive annual grasses such as cheatgrass and medusahead rye and other annuals.	Selective ALS- inhibiting herbicide applied both pre-and post-emergence to target annual species such as cheatgrass and medusahead rye.
Triclopyr	Broadleaf weeds,thistles, saltcedar.	A growth-regulating herbicide for control of woody and broadleaf perennial weeds in non-cropland, forest lands, and lawns.

Table D-2. Herbicide Modes of Action

Group #	Mode Of Action	Active Ingredient
2	ALS inhibitors	Chlorsulfuron, Imazapic, Metsulfuron-methyl, Rimsulfuron
4	Synthetic Auxins (Growth Regulators)	2,4-D, Aminopyralid, Clopyralid, Dicamba[1], Fluroxypyr, Picloram, Triclopyr
9	EPSP Synthase Inhibitors	Glyphosate
19	Auxin Transport Inhibitors	Diflufenzopyr[1]

[1] Cannot be applied aerially.

Group 2 - Acetolactate synthase (ALS) inhibitors block the normal function of the ALS enzyme which is responsible for low branched-chain amino acid production. Herbicides within this group are generally used for selective weed control and are effective in controlling broadleaf weeds and invasive annual grasses. Herbicides within this group can be applied as a pre-emergent control method and/or post-emergent. Timing of application can affect the degree of impacts to both target and non-target vegetation. Late summer to late fall applications would typically be utilized to inhibit seed germination of invasive annual plants. Timing of seedings following herbicide application would be considered to promote the establishment of desired vegetation. Ground and Aerial broadcast applications of herbicides in this group would be used for both site preparation for restoration and rehabilitation, and to reduce competition of invasive annual plants and noxious weeds in already established perennial plant communities. Residual impacts from this group vary, dependent on environmental conditions that may speed or slow the rate of decay. The impacts related to this delayed breakdown include a longer control of targeted invasive plants.

Groups 4 and Group 19 – Group 4 (Synthetic Auxins) and Group 19 (Auxin Transport Inhibitors) disrupt growth regulation in broadleaf plants. These groups are effective at post-emergent control, particularly on broadleaf plants. Actively growing plants are typically more susceptible. However, regrowth can occur at low application levels, which can minimize the impacts to non-target plants, but also reduces effectiveness of control in target plants. Synthetic auxins can be combined with other herbicides to improve efficacy of control of target species. This group could be particularly effective at controlling perennial noxious and invasive weeds on both isolated, spot applications and on broadcast, larger-scale applications with minimal impacts to the natural diversity of a project area (2007 PEIS). Diflufenzopyr is the single active ingredient proposed for use that is part of Group 19. It is applied postemergence to control broadleaf weeds, although it may be weakly effective when used alone. However, when combined with dicamba (Group 4), diflufenzopyr can improve the effectiveness and lower the application rate required to control noxious weeds. Diflufenzopyr in formulation with *dicamba* is trademarked as Overdrive® and Distinct®, and is effective at controlling invasive broadleaf weeds, such as knapweeds and thistles, which makes it an effective tool to utilize in areas with good perennial grass composition.

Group 9 - Aromatic amino acid inhibitors (Enolpyruzyl Shikimate-3-Phosphate (EPSP) Synthase Inhibitors) are non-selective, post-emergent herbicides, which can cause death at high application rates to all plants. Glyphosate is the only active ingredient proposed for use in this group. Typically, rangeland application for this group would target invasive annuals, and may cause some short-term damage to perennial plant species. However, higher rates and timing could be used to kill target perennial vegetation, such as non-native perennials, when active restoration to a natural plant community is the desired outcome. Glyphosate could be combined with other herbicides, such as imazapic (Journey®) to provide immediate control of emergent and growing plants, and to provide residual pre-emergent control.